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Notes on the feeding behaviour of the Milky Stork *Mycteria cinerea*

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As part of the Interwader East Asia/Pacific Shorebird Study Programme in 1984, we studied the foraging behaviour and prey selection of birds living on intertidal flats around the Malay Peninsula. The opportunity arose to observe a Milky Stork *Mycteria cinerea* for one hour at close range with the help of a 40 × 60 telescope from a hide. Little has been published on the behaviour of this large bird, which at present is scarce and may be in danger of extinction in Malaysia, and indeed is currently regarded as globally threatened (King 1978–1979). The following observations may, therefore, be of interest.

Our bird was discovered on an intertidal mudflat near Sungai Burung, Perak State, peninsular Malaysia, about one hour after low tide on 9 October 1984. According to local fishermen, Milky Storks were regularly to be seen foraging on the flats in that area, which is only 20km north of the Pulau Kelumpang Forest Reserve, the main roost site for Milky Storks where we had counted 101 birds a few days earlier (see Plate 1; also Plate 2). The white head feathers, yellow-orange bill and pink legs indicated that our bird was an adult. It was foraging at a distance of about 25–100m in front of the mangrove. It avoided coming nearer to the vegetation and spent its time walking through the large pools on the flat or visiting the water's edge.

The flat consisted of very soft mud and was impassable for man (one sank in waist-deep). When walking, the very long tarsi of the stork only sank in about 6cm (a quarter of their length), but when standing still to probe or preen, the tarsi sank in about 15–20cm (about three-quarters of the length of the tarsus). Probably the thick, long toes of the species reduce pressure by increasing the surface area of the feet and hence help it cope with soft substrates.

Detailed observations on the foraging behaviour could only be made for 39 minutes. For the remaining 21 minutes the bird rested, preened or was alert because of people within sight. While feeding, the bird walked or waded through the mud with great deliberation, making 6 to 60 steps per minute (mean of 22.5 ± 16.3 steps per minute). This number appeared to be strongly negatively correlated with the number and duration of probes.

Three feeding methods were observed in this individual, two of them tactile (probing in mud, groping in shallow water), the third being direct visual searching. On the mudflat the stork searched for large, water-filled holes in the mud. It probed in and around these holes with the mandibles open about 6 cm wide at the tip. The slightly curved mandibles were inserted and partly withdrawn a number of times over 5 to 32 seconds (mean 16.5 ± 8.7 seconds) per hole. Most probings were to a depth of 15 to 18 cm (three-quarters the bill length), but occasionally went up to the full length of the bill (about 23 cm) and even up to the eyes. Before a prey was captured, the bill was always inserted to its full length. Occasionally, starting from a hole, the bill was inserted from half to three-quarters of its length and ploughed through the mud in a straight line for about one metre ahead creating a runnel in the soft mud.

Only one fish was clearly located by sight, as after a short rest the bird suddenly flew about 5 m, alighted, and immediately caught a fish without probing deeply. All other fish were caught by probing in and around deep

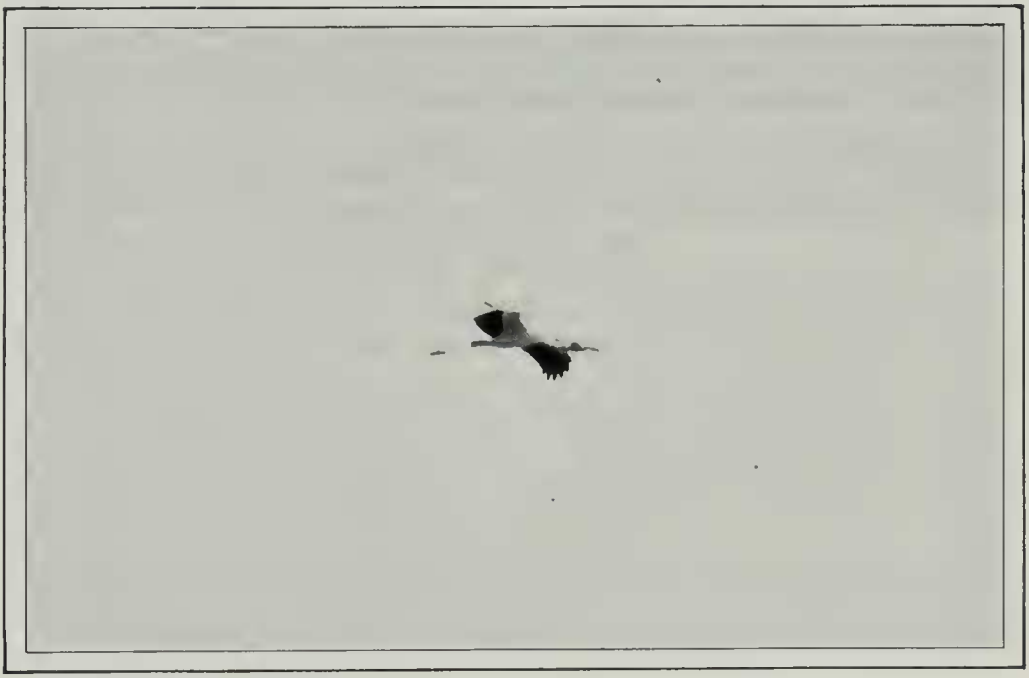
Plate 1. A group of Milky Storks *Mycteria cinerea* flying to rest in the Pulau Kelumpang Forest Reserve, October 1984. (Photo: C. Swennen and E. C. L. Marteijn)

holes in the mud. The bird probed in 2.3 ± 0.7 different spots per minute and on average caught one prey every four minutes. The prey was pulled out of the mud and swallowed with a few catch-and-throw movements. All prey were rather large mudskippers Gobiidae. The length of the fish could be estimated in relation to the length of the bill (± 23cm): $2 \times 10-14$cm, $3 \times 14-18$cm, $2 \times 18-22$cm, 1×23cm. After catching a fish, greyish mud usually stuck to the whole bill, which was then cleaned by moving up and down in a water-filled hole, while rapidly opening and closing the mandibles. After a few seconds the bill came out bright orange-yellow again. When a large fish was swallowed, the bird rested for 20 to 58 seconds before starting to forage again.

At a great distance we saw other Milky Storks feeding on a mudflat whilst standing and slowly walking up to their belly in the extremely turbid rising water. The birds were holding their bills in front of their bodies in the water for long periods. The distance was too great to study their behaviour and its success in any detail. This behaviour was similar to the 'groping' feeding of storks described by Kahl (1964) as the main feeding strategy for the closely related Wood Stork *Mycteria americana*. Kahl does not record the latter species as probing in sediments.

The only other ciconiiform birds seen feeding in the area were Little Heron *Butorides striatus* and Little Egret *Egretta garzetta*. Both species were feeding by standing motionless and waiting until a fish was seen nearby,

Plate 2. Adult Milky Stork soaring over Kuala Gula, October 1984. (Photo: C. Swennen and E. C. L. Marteijn)



contrasting with the tactile feeding of 'our' slowly-walking Milky Stork.

Discussion

For the Milky Stork observed, foraging on an exposed flat, the estimated wet weight of the fish eaten in 39 minutes was 225 g (estimated by comparison with weights of fishes of similar length). In the Wood Stork, Kahl (1964) found the daily intake of fish for birds in captivity was up to 16% of the body weight, and estimated the intake of wild Wood Storks at 21% of their body weight. As the estimated weight of a Milky Stork is about 3 kg, one may expect a daily intake of 630 g of fish. This means that a Milky Stork may be able to capture its daily ration in only about two hours of intensive feeding. Feeding on exposed flats depends on the tides, but on most days ebb tide is low enough to be used by the birds in this way.

Vast mudflats teeming with mudskippers occur along the west coast of the Malay Peninsula. Therefore it seems that the decline of the breeding population of the Milky Stork in Malaysia, of which only 115 individuals are left (Parish 1984), cannot be caused by lack of food or of potential feeding grounds.

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